Measuring National Culture by Analyzing Business Processes: A Case Study in Germany and India

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Abstract. Nowadays, many companies face problems because of cultural differences, especially in multinational settings. Traditionally, national cultures have so far been identified by questionnaires asking participants about e.g., their values. These invisible elements of culture become manifest in tangible artifacts such as concrete actions or structures, e.g., rituals and organizational charts. Process models serve as a graphical representation of processes precisely describing activities, responsibilities and process flows. Thus, we anticipate that the behavior becoming apparent in process models provides insights into national characteristics. Consequently, the goal of this paper is to develop an approach to measure national culture in process models. Based on Hofstede's (2010) cultural dimensions, we define metrics that can be applied to process models. We demonstrate the use of these metrics by applying them to a process executed both in a German and an Indian company. Our analysis confirms a correspondence of the metrics' results with Hofstede's findings.

Keywords: National Culture, Business Process, Measurement Approach, Case Study

1 Introduction

National cultural characteristics and their influence on collaboration, both within and among companies, is an important research area in times of globalization [1,2]. Neglecting cultural peculiarities may lead to disastrous consequences. A plane crash involving Avianca Airlines in the 1990's, which was, ultimately, caused by a specific cultural behavior of the crew members may serve as a warning example. In this crash, the co-pilot did not challenge a wrong interpretation of the instruments by the flight captain because he came from a country where subordinates are generally afraid of expressing disagreement with superiors [3]. In IS research, problems caused by cultural differences have been addressed, too. For example caused by different communication styles (in Japan and the US) leading to poor information sharing or caused by different norms for decision-making (Mexico and South Korea) [4].

To make a global collaboration setting more beneficial for all parties, it is essential to be aware of all cultural peculiarities and differences of the individual stakeholders, e.g., customers and suppliers in foreign countries [2]. As all of these stakeholders are

13th International Conference on Wirtschaftsinformatik,
February 12-15, 2017, St. Gallen, Switzerland

Wehner, B.; Falk, T.; Leist, S.; Ritter, C. (2017): Measuring National Culture by Analyzing Business Processes: A Case Study in Germany and India, in Leimeister, J.M.; Brenner, W. (Hrsg.): Proceedings der 13. Internationalen Tagung Wirtschaftsinformatik (WI 2017), St. Gallen, S. 196-210

connected by business processes, the analysis of cultural peculiarities in relation to business processes is a promising research area. Schein [5] highlights that "*for purposes of cultural analysis, the organizational processes by which such behavior is made routine"* (p. 26) can be used. Business processes are generally captured by process models in various process modeling notations, all of them aiming at graphically representing the actual process as closely as possible. Thus, we anticipate that different cultural aspects can be identified in these process models, as they reveal the behavior, responsibilities, and the sequence flow of tasks.

To date, research has assessed national culture by the use of questionnaires (e.g., [6,7]), asking respondents about their beliefs and assumptions. As questionnaires are very time-intensive, expensive and the intended behavior is only analyzed, a measurement approach that reflects observable behavior on the basis of the employees' daily routines complements questionnaires with new aspects. For example, details on the hierarchy in a company can be inferred [8] when analyzing who makes decisions in a process model. In this paper, we analyze process models by means of metrics, as metrics are a well-known means to identify influencing factors on processes [9]. We anticipate that an analysis of business processes in terms of culture will provide a company with valuable insights into the cultural attitude of the process participants, e.g., if employees culturally fit to the tasks they perform. This knowledge can then contribute to various phases of the BPM lifecycle: To design a process that is perfectly aligned to the cultural attitude of the process participants, to determine a cultural fit of two companies' processes during mergers and acquisitions [10] or to analyze if culture is the origin of process performance problems, a correlation that has recently been identified [11]. Altogether, the goal of this paper is to develop a measurement approach applied to business process models, which in a first step measures selected national characteristics. The resulting metrics form the basis for discussions about discrepancies between national culture and its manifestation in companies.

The remainder of this paper is organized as follows: in section 2, we provide an overview of culture, business process management and measurement of national culture. Section 3 presents the operationalization of the cultural dimensions, the deduction of metrics, and the process of data collection. In section 4, we apply these metrics to process models of two companies, one from Germany and one from India, and present the results. The insights gained from the application of the metrics are discussed by comparing them to the comprehensive study by Hofstede [6] in section 5. The last section gives a summary of our research, names limitations and proposes options for further research.

2 Conceptional Background

2.1 Culture

Culture is a rather diffuse concept with different meanings depending on the context [12]. A definition often used, as it comprises the general aspects of culture, was evolved

by Schein [5] with culture being referred to as shared values of a group, which can be recognized in actions and structures.

Culture can generally be presented as an iceberg model [13], with both visible and invisible elements. Invisible elements are *Underlying Assumptions* (e.g., ideology, feelings, taken-for-granted beliefs [13,14]) as well as *Espoused Beliefs and Values* (e.g., morale, ethical norms) [1,5], often subsumed by researchers under the term values [14,8]. Invisible elements of culture manifest themselves in tangible *Artifacts* [5], which represent the visible elements such as concrete actions or structures (e.g., behavior, organizational charts) [13]. According to the range of influence, different levels of culture can be defined, e.g., national, organizational, and subgroup culture [1,14]. Each cultural group shares characteristics distinguishing one from another [6].

Basically, the culture in a company is influenced by the deeply embedded national culture as well as the particular organizational culture [10]. However, the organizational culture is always subject to the basic assumptions of the national culture. This has been demonstrated in various cases by Schneider [15], who analyzed human resource practices in multinational companies. In these cases, national characteristics had a stronger influence on work practices than corporate identity. This fact was also confirmed by other surveys (e.g., [16]). Even though there will always be a coherence between organizational and national culture, Hofstede et al. [17] point out that they are also distinctive due to different cultural dimensions (a list of dimensions is presented in [14]).

In this paper, we focus on national culture that is stable over time [2] and difficult to influence as it represents the basic behavior and values of a particular society [1] and has a predominant effect on people as compared to the organizational culture [10,15]. Even though the concrete personal behavior of individuals belonging to a national group may differ, generally valid tendencies can be observed for certain cultural dimensions [6,8].

2.2 Culture and Business Process Management

Culture has been identified as an important aspect of BPM [18,19], too, and the number of publications linking the two topics has indeed increased in recent years. Research in this area can be classified on the basis of two dimensions: the interrelation between culture and BPM and the referenced cultural group. In this respect, the main emphasis lies on organizational culture and its impact on BPM activities or business process performance (cf. [20,21]). Besides, the concept of a distinct *BPM culture* was identified and its values operationalized [22].

The role of national culture in BPM has been much less highlighted in existing research. Authors dealing with this topic analyze the national influence on BPM [23] and the application of BPM concepts in different national contexts [19,24]. Central to BPM is the notion of a business process consisting of a cohesive sequence of functions that create an output by adding value to the input and thus fulfil an organizational task [25]. Business processes represent a socio-technical system in which humans collaborate and carry out the single tasks to achieve the process output [26].

2.3 Measurement of National Culture

So far, national culture in a broader sense has been assessed by means of surveys, asking respondents questions about their feelings, beliefs, morale, or how they would behave in certain situations [6,7]. Well-known examples are a survey by Hofstede [6] with approx. 116,000 respondents in 76 countries and the GLOBE study with 17,300 interviewees in 63 countries [7]. Questions in cultural surveys generally target the two layers of *Underlying Assumptions* and *Espoused Beliefs and Values*. As a result, visible *Artifacts* are not dealt with. An important category of visible *Artifacts* are process models graphically representing business processes using semi-formal modeling techniques. In a process model, the process is decomposed into a set of interrelated activities that are logically and temporally connected. Using semi-formal modeling techniques helps to increase the specificity of the description and to avoid the ambiguity, which, for instance, natural or narrative texts often imply [27]. Therefore, process models precisely describe the interaction among people, technology and organizations with the aim of improving the effectiveness and efficiency of organizations. Whereas to-be process models represent how people should interact from a management or process owner view, our analysis focuses on as-is process models. As we want to capture the real behavior of people and how they execute their tasks and activities, we analyze the process in its current form. Since as-is models describe this behavior, they reflect the culture of individuals in a country, thus being different from models of other nations. This difference is expected to be detectable and can be measured for each national dimension.

3 Measurement Approach

Our approach is based on predefined metrics that are applied on to business process models. The definition of the required metrics comprises three steps: first, we analyze the operationalization of cultural dimensions in general. Second, three national dimensions by Hofstede et al. [8] are presented and then used to deduct metrics to measure them. Finally, we describe the process of data collection, which is the basis for the calculation of the metrics.

3.1 Operationalization of Cultural Dimensions

The best-known classification in national cultural research are the dimensions by Hofstede et al. [8] (cf. [2,14]), which represent the basic behavior and nature of national cultures: Power Distance, Uncertainty Avoidance, Individualism, Masculinity/Femininity, Indulgence, and Long-Term Orientation [8]. Further studies expand these basic dimensions by detailing or extending them, by e.g., assertiveness, performance, and humane orientation [7], time orientation, and locus of control [14]. As Hofstede describes the most popular conceptualization of national culture [28,29], we take his taxonomy as a basis. In this first step, we develop metrics for the dimensions *Power Distance*, *Uncertainty Avoidance* and *Individualism*, as these were identified as fundamentally distinguishable between nations [6] and are very well defined so that it is possible to derive metrics. In the next section, these dimensions are explained in detail.

We follow the approach by Harvey [30] who operationalized the dimension *Uncertainty Avoidance* to assess differences between design documents and actual design practice. He defined particular characteristics of the dimension *Uncertainty Avoidance* and discussed the differences in each characteristic. We transfer and formalize this approach as follows: Generally, each cultural dimension (CD) comprises several characteristics (C) that can be measured. Metrics (M) are defined to measure the extent of each characteristic. Afterwards, the metrics are aggregated (Agg) for each cultural dimension to obtain a tangible value that can further be interpreted and compared. Figure 1 provides an overview of all components of our measurement system (cf. [30]).

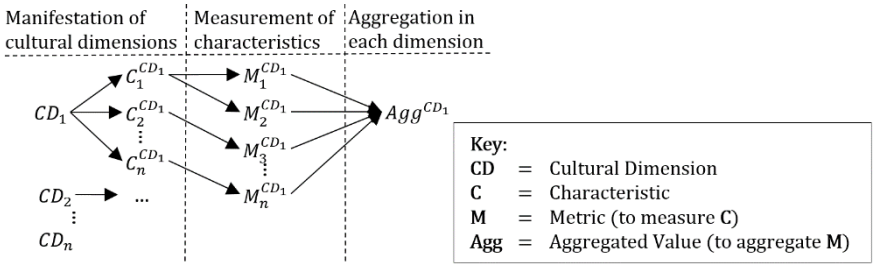

Figure 1. Measurement Approach

To obtain the values for the metrics, the business process models are analyzed. There is a great variety of process modeling notations, the most popular ones being BPMN, EPC and the UML Activity Diagram. Even though different notations exist, most of them offer similar key elements: functions, organizational units, application systems, information objects and connectors [25]. These elements are used to calculate the metrics by analyzing the semantics and the syntax of a process. Elements can be classified with regard to semantics by their element type and by interpreting their labels. Syntax is analyzed to identify sequential, parallel, or alternative process paths (see section 3.3).

3.2 Deduction of Metrics from National Dimensions

The three aforementioned cultural dimensions (CD) by Hofstede et al. [8] are manifested in well-defined characteristics (C). In each dimension, we derived the characteristics analyzing the definitions and descriptions [30]. Furthermore, we analyzed the single items of the questionnaire by Hofstede et al. [8] to stay as close as possible to the original intention of each dimension. As there is also a manual available on how to calculate each dimension on the basis of the questionnaire items, the relevant items in each dimension were selected[1]. Both the definitions and the items in the questionnaire were finally used to derive characteristics that can be developed to metrics, which, in turn, can then be applied to process models. In the following, the deduction of the dimension *Power Distance* is presented in detail and the deduction of the metrics from the other two dimensions is summarized.

[1] The questionnaire and the manual how to use it are available at: http://geerthofstede.com/research-and-vsm/vsm-2013/ (last access: 24.10.2016)

In a cultural group, the power of individuals is not equally distributed. *Power Distance* is defined as the extent of this power and the degree as to which the less powerful accept the existing distribution [6]. In the questionnaire, four questions are asked (item numbers m02, m07, m23, and m26) to calculate the Power Distance Index (PDI) as it is originally named [8]. The questionnaire asks e.g., how important it is for employees to be consulted by their boss in decisions involving their work (m07) and how often subordinates are afraid to contradict their boss (m23). On the basis of the definition and the questionnaire items, two characteristics can be defined: acceptance of unequal distribution of power and unequal distribution of power. With regard to process models, they do not 'betray' any personal feelings, and it is not possible to identify the degree of acceptance of inequality by the less powerful ones in them. Thus, we focus on the extent of unequal distribution of power. The original intention to measure the extent of unequal distribution of power can be identified by looking at single functions, which can be performed by an organizational unit either on a lower or on a higher level. These tasks are checks of results, which is a source of contradiction (m23) and making decisions (m07). If a check is performed by a superior and not by a regular employee, the power is focused on a higher level in that particular case. Thus, the derived metric for a whole process indicates the share of check functions performed by organizational units on a higher level in relation to all check functions performed within the process ($PD_1 = \frac{|CF_{HL}|}{|CF|}$). The assignment of the right to make decisions is the second area for which to show the distribution of power depending on the hierarchy level of organizational units. The metric indicates the share of decision functions that are performed by organizational units on a higher level in relation to all decision functions in the process ($PD_2 = \frac{|DF_{HL}|}{|DF|}$). For both metrics, a high value indicates high *Power Distance*.

Uncertainty Avoidance deals with the unpredictability of situations. It is defined as the extent to which individuals try to avoid uncertain situations by relying on common norms, rituals and practices, e.g., by using standardized documents [6,30]. Additionally, the items m16, m20, m24, and m27 in the questionnaire to calculate the "Uncertainty Avoidance Index" (UAI) are in focus, e.g., the question as to which extent an employee agrees with the statement if one can be a good manager without having precise answers to a question a subordinate may raise (m24). To measure the first characteristic (avoidance of uncertain situations), we explicitly search for functions dealing with quality issues, e.g., the use of a checklist or the four-eyes principle. Quality functions are usually meant to document a current state or to check for a deviation from the outcome, which indeed reduces uncertainty in the specified topic. Thus, if the share of quality functions in relation to all functions is high, a high degree of uncertainty avoidance is measured. In addition, information objects in process models, e.g., checklists, indicate a reduction of uncertainty. The second metric for this characteristic shows the share of quality documents in relation to all documents in a process.

Individualism refers to the intensity of the interdependence of the members of a cultural group and to the extent of people taking care of each other. In individualistic societies, members look after themselves and their direct environment only, while people in collectivistic societies belong to groups. For example, people working in project teams with a high degree of interdependence and a lot of meetings form a collectivistic

group [6]. With regard to the questionnaire, e.g., the item was chosen which asks how important it is for an employee to be surrounded by likeable people in a pleasant working atmosphere (m05). The intensity of interdependence can be identified in a process model by looking at the organizational units of each function. Functions with more than one organizational unit show the interaction among them, e.g., the participants of a meeting. A small share of those functions in relation to all functions indicates a small degree of interdependence and an individualistic attitude. While databases are often used to share information, they also represent a form of individualism if they are not shared among employees. Employees create their own data storage, e.g., a sales person who stores product data on his own device when traveling. The metric measures the share of isolated databases in relation to all databases. A high value indicates that the data is not available to other employees. The degree as to which people take care of each other is not directly measurable, as process models do not show in what way people interact. In each dimension, two metrics were derived on the basis of the definitions and questionnaire items. Thus, our metrics follow the same intention that Hofstede [6] measured with his questionnaire.

3.3 Process of Data Collection

To apply these metrics on process models, their elements have to be analyzed (section 3.1). Figure 2 illustrates an exemplary analysis of a business process model with the cultural values extracted from it. In general, all objects of a process model have to be analyzed either individually or in combination with connected objects. An example is a decision function that can be identified by a subsequent XOR-connector (syntax). Still, the semantics of the function needs to be assessed for final classification to a variable, as also a check function is usually followed by an XOR-connector (see Figure 2). Thus, for each metric, we present a detailed procedure of how to gather the values.

Check functions (CF) are identified by a semantic analysis of two consecutive functions, with the first one producing a result that is checked in the second one. For example, in Figure 2, the quantities and times in the product development list are checked. If this check is performed by an organizational unit of a higher hierarchical level, there will be a value for variable CF_{HL}. Continuing the example, the check of quantities and times is performed by the technical managing director, while, prior to that, the quantities and times were determined by a technician. As a technician is a subordinate of the technical managing director, there is a difference in hierarchy.

Decision functions (DF) are identified by analyzing the syntax and the semantics of the functions and the process flow. Decision functions are followed by alternative process paths indicated by “XOR” or “OR” connectors, e.g., the decision whether a product will be developed or not. Depending on the organizational unit that performs the function, different decision functions can be identified: DF_{HL} indicates a decision made by an organizational unit of a higher hierarchy level than the other organizational units in the process, e.g., a managing director. Quality functions (QF), e.g., the creation of a product specification, can be identified by a semantic analysis of functions. Functions that are performed by only one organizational unit ($F_{OU=1}$) can be identified by a syntactical analysis of the related organizational units that perform a function individually.

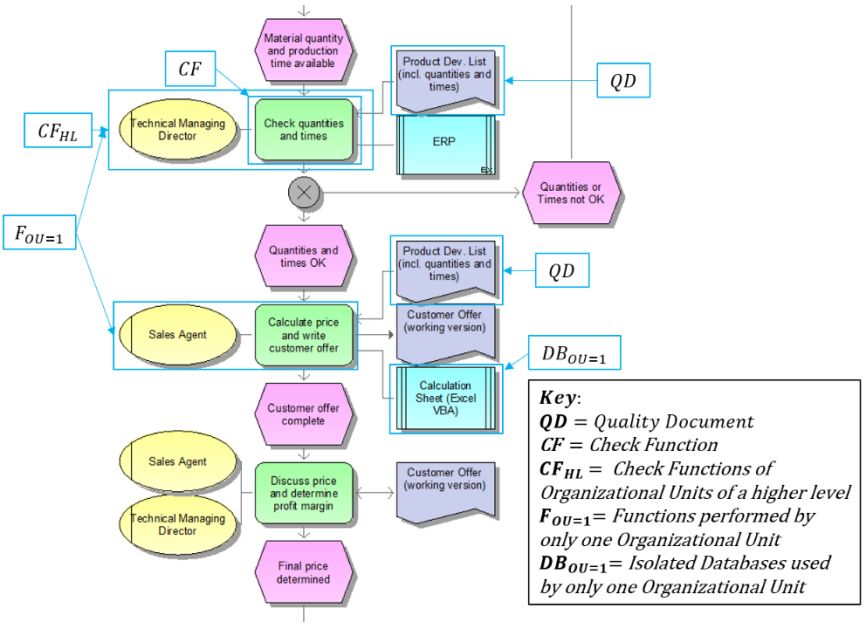

Figure 2. Example of the Data Collection

In addition to functions, information objects are used to measure cultural characteristics. Quality documents (QD) are a subset of all documents (D). They can be identified by selecting those documents that deal with quality issues, e.g., checklists or test reports. Furthermore, isolated databases ($DB_{OU=1}$) can be identified by determining the connection between databases and organizational units. If a database is used by only one organizational unit, it is referred to as an isolated database.

4 Application of Metrics

4.1 Business Processes from Germany and India used for the Application

As cultural values are only meaningful by comparison [8], the metrics derived were applied on business processes of two small and medium-sized enterprises (SMEs) in Germany and India. Both act as suppliers developing and manufacturing similar small electronic components, e.g., transformers, coils, converters.

Out of all business processes, the customer-specific product development process was chosen for the cultural analysis, as both companies develop similar products, which have an analogous complexity and a similar quality required of the output. Due to the high number of products (approx. 350 in each company) that have been developed so far, a high degree of process standardization is available, too, and a similar number of employees performs this process, 11 in the German and 12 in the Indian company. Finally, this process was chosen because it is completely non-automated. Thus, all these

similarities ensure the comparability of the German and Indian process so that the cultural characteristics based on human behavior may be fully concentrated on.

The process models we used for our cultural analysis were created in a prior project using the EPC. Even though they were modeled by one and the same modeler, in accordance with identical modeling guidelines and at a comparable level of detail, it was necessary to understand all the details of the processes and check if they were up-to-date. For this purpose, we conducted personal interviews with both the German and the Indian employees involved in the processes. In addition, we were informed about all documents and information systems during on-site visits. On this basis, we slightly revised the models and assured that our analysis was based on the "as-is" models.

The customer-specific product development process starts with a customer asking for a custom-tailored product in the form of a request or tender sent to the SME. This step is followed by an initial design and a subsequent quotation submitted to the customer. In case the customer places an order, the SME designs the product and builds a prototype, which is sent to the customer. After the approval of the prototype, production is planned and initiated. The final steps comprise invoicing and handling of payments. This process is executed in both companies, with some differences regarding the actual process flows and responsibilities. The individual processes are comprised of 60 functions in the German and 71 in the Indian company. Against this background, the values of the variables were independently assessed by two researchers and their results compared afterwards, being identical in almost all cases, showing only slight differences for the rest. The differences were discussed with a third researcher. If no final decision could be made, the differences were discussed with the two companies until a consensus was found to ensure a maximum degree of objectivity when applying the metrics.

4.2 Results of the Application

The values of the variables to calculate the metrics were collected by way of a semantic and syntactical analysis of the processes for both the SMEs as described in section 3.3. We analyzed all objects of both business processes and classified them to the variables that are needed to calculate the metrics. For example, as shown in Figure 2, the Technical Managing Director performs the function *check quantities and times*, which was classified to CF_{HL}. Table 1 shows the defined metrics including a short description, the absolute numbers gained from the process analysis, and the calculated metrics for the German and the Indian company for each cultural dimension. According to our measurement approach, the values of the individual metrics are aggregated for each cultural dimension as well.

Regarding the cultural dimension *Power Distance*, the aggregated value Agg^{PD} is determined by calculating the average of PD_1 and PD_2. Possible and expected values range from 0 (low) to 1 (high Power Distance) for each metric and thus for the aggregated value, too. In the Indian company, 50% of the check functions and even 72% of the decision functions are performed by higher level organizational units, while in the German company only 29% of the checks and 22% of the decisions are made by their

counterparts. The aggregated value is 0.61 for the Indian and 0.25 for the German company. Based on these values, we can state that the process reflects a higher Power Distance in the Indian than in the German company.

The aggregation for Uncertainty Avoidance is determined by calculating the average AggUA of the two metrics associated with this cultural dimension. For the two metrics, possible values range from 0 (low) to 1 (high Uncertainty Avoidance), which is also valid for the aggregated value. UA1 reveals that the German process has a share of 28% of quality functions, which means that almost one in three of all functions is quality-related. The Indian process shows a lower share of 17%, which equals less than every fifth function. This tendency is also reflected in the share of quality documents (UA2) with 50% in the German and 16% in the Indian company. In summary, the aggregated values of 0.39 in the German and 0.17 in the Indian company reflect a higher avoidance of uncertainty in the German company.

Table 1. Application of the Derived Metrics (*OU=Organizational Unit)

			Absolute Numbers		Calculated Metric	
	Metric	Description	Ger.	India	Germany	India
Power Distance	$PD_1 = \frac{\lvert CF_{HL}\rvert}{\lvert CF\rvert}$	$\frac{\text{Check Functions of OUs* of a higher level}}{\text{Check Functions}}$	$\frac{2}{7}$	$\frac{4}{8}$	0.29	0.50
	$PD_2 = \frac{\lvert DF_{HL}\rvert}{\lvert DF\rvert}$	$\frac{\text{Decision Functions of OUs* of a higher level}}{\text{Decision Functions}}$	$\frac{2}{9}$	$\frac{8}{11}$	0.22	0.72
				Agg^{PD}	0.25	0.61
Uncertainty Avoidance	$UA_1 = \frac{\lvert QF\rvert}{\lvert F\rvert}$	$\frac{\text{Quality Functions}}{\text{Functions}}$	$\frac{17}{60}$	$\frac{12}{71}$	0.28	0.17
	$UA_2 = \frac{\lvert QD\rvert}{\lvert D\rvert}$	$\frac{\text{Quality Documents}}{\text{Documents}}$	$\frac{8}{16}$	$\frac{4}{25}$	0.50	0.16
				Agg^{UA}	0.39	0.17
Individualism	$Ind_1 = \frac{\lvert F_{OU=1}\rvert}{\lvert F\rvert}$	$\frac{\text{Functions performed by only one OU*}}{\text{Functions}}$	$\frac{50}{60}$	$\frac{50}{71}$	0.83	0.70
	$Ind_2 = \frac{\lvert DB_{OU=1}\rvert}{\lvert DB\rvert}$	$\frac{\text{Isolated Databases used by only one OU*}}{\text{Databases}}$	$\frac{1}{2}$	$\frac{1}{3}$	0.50	0.33
				Agg^{Ind}	0.67	0.52

The aggregated value of the dimension *Individualism* is determined by building the average (Agg^{Ind}) of the metrics Ind_1 and Ind_2, with 1 indicating a high degree of Individualism and 0 indicating a high degree of Collectivism. The metric values show that in the German process 83% of all functions are performed individually, which indicates a higher degree of individualism than in the Indian process with value of 70% (Ind_1). In the German company, 50% of all databases and 33% in the Indian subsidiary are only used individually (Ind_2). The aggregation Agg^{Ind} results in a value of 0.67 in the German and 0.52 in the Indian company, indicating that the German company is more individualistic than the Indian company.

In summary, all of the derived metrics were applicable on the modeled processes in both the German and the Indian companies, and a clear tendency for each cultural dimensions was identified.

5 Discussion

As we have demonstrated in the previous section, it is possible to identify and measure cultural dimensions in business process models. We operationalized three of Hofstede et al. [8]'s cultural dimensions in process models by deriving metrics analyzing the use and structure of process model elements. Our analysis of the results (see section 4.2) revealed a clear diversity between the German and the Indian process models regarding our cultural metrics. Even though we cannot interpret the derived values as absolute numbers, a clear tendency of the three cultural dimensions for each of the two process models is obvious. For a better interpretation of our results, we opposed them to the findings of the comprehensive study by Hofstede et al. [8] regarding the three cultural dimensions in the two countries Germany and India (see Table 2). Hofstede et al. [8] use a scale from 0 (low) to 100 (high) to rate their cultural dimensions. In comparison, our metrics' values range from 0 (low) to 1 (high). While this means that we cannot directly compare the two scales, we can compare the values of the two countries against their respective scale to reveal a tendency in each cultural dimensions.

Looking at *Power Distance*, Hofstede states a value of 35 for Germany and 77 for India, indicating that Germany has a lower Power Distance than India [6]. Our analysis of the process models comes to a very similar result as our metrics classified the process models of the German company (0.25) showing a lower Power Distance than the ones of the Indian company (0.61). *Uncertainty Avoidance* has a value of 65 in Germany and 40 in India according to Hofstede, displaying a higher avoidance of uncertainty in Germany. These findings are congruent with our measures: The analyzed process models evidence that there is a higher avoidance of uncertainty in the German company (0.39) than the Indian one (0.17). Hofstede's third cultural dimension rates the degree of *Individualism* in a society. His survey states a value of 67 for Germany and 48 for India, reflecting a higher Individualism for Germany in comparison to India. Our results are in accordance with this tendency as we calculated 0.67 for Germany and 0.52 for India using our metrics.

Table 2. Comparison of Calculated Metrics and Survey Results by Hofstede et al. [8]

	Aggregated metrics			Survey by Hofstede et al. [12]		
	Germany		India	Germany		India
Power Distance	0.25	<	0.61	35	<	77
Uncertainty Avoidance	0.39	>	0.17	65	>	40
Individualism	0.67	>	0.52	67	>	48

We see a contribution of our research to both theory and practice. From a scientific point of view, cultural aspects in BPM have mostly been disregarded [18], even though culture has a direct influence on process performance [20]. Our metrics are a new instrument to measure national culture in process models and thus contribute to this research gap of BPM. Up to now, cultural research has largely relied on surveys, which primarily focus on the layers of *Underlying Assumptions* and *Espoused Beliefs and Values*. In contrast, our proposed metrics focus on the layer of *Artifacts*, thus allowing for

further aspects of cultural research to be investigated. In addition, due to the fact that our metrics are well-defined and the data collection instructions are quick and easy to apply in a real-life context, the extraction of the underlying process variables is very cost-effective as compared to e.g., questionnaires. Since the necessary information is inherent in BPM systems and data collection is in many cases automated, e.g., gathering the as-is process using process mining algorithms, we therefore expect a broad application basis. Our metrics contribute to practice in other areas, too. Looking at BPM in particular, the metrics can be applied to support the different phases of the BPM life cycle:

(1) In the design phase, the process modeler creates a process that has to be aligned to the national cultures of the users involved. For example, they can be applied in - especially international – mergers and acquisitions (M&As) that play a predominant role in times of globalization [31]. There, cultural "collisions" [10] are observed, which are seen as a possible reason why 50 to 60 percent of M&As fail eventually [31,32]. In this regard, our approach helps to assess the national differences in the companies involved by calculating and comparing the metrics of the processes to be merged. Thus, our metrics help to highlight the cultural compatibility and to detect cultural collisions before the actual process harmonization takes place. A high degree of cultural equality between the companies' processes will lower integration costs and help employees to easier adapt to the new, joint processes. Finally, the failure rate of M&As can possibly be reduced. The same reasoning is valid for outsourcing initiatives. A close cultural fit of the insourcer's processes with the ones of the outsourcing company may be seen as an indicator of a seamless integration. Besides the harmonization of two processes, the modelers of a process may calculate our metrics on its own processes and compare the values to benchmarks and reference values. A modeler can then check whether the process they design fits the cultural expectations in advance ensuring a high rate of adoption among the users. In addition, the importance of culturally aligning a business process that involves users from several different countries and cultures is obvious. For example, it is necessary to consider the national culture when designing offshoring processes [10], or when transferring an IT-system to a subsidiary in a foreign country [33].

(2) Our metrics also contribute to the analyze phase of BPM. When a company experiences problems with their process performance, e.g., right after implementing a new process, our metrics help to analyze whether cultural issues are the cause of these shortcomings. In fact, there is empirical evidence, that culture affects the process quality (survey, cf. [20]). Thus, our metrics support a company by indicating whether a business process fits the cultural needs and expectations of all parties involved. For example, when employees from different countries work together, problems due to their different cultural backgrounds may be expected, which affects multinational companies in particular [29]. By comparing the metrics to a benchmark or reference value, possible causes may be identified, which can be further evaluated in an upcoming BPI initiative.

(3) In the improvement phase, the culturally induced causes for a decreasing process performance can be eliminated. In this regard, the descriptions of the metrics help to identify improvement possibilities and, thus, to define measures to align the process to the employees' expectations. Further, the comparison with benchmarks or reference values give further hints in which cultural dimension the roots of the problems may

particularly be. In summary, as described above, we are convinced that our metrics are a new means to make culture a tangible construct from a BPM perspective.

6 Conclusion

In this paper, we present a measurement approach to identify national culture in business process models. We defined six metrics for the national dimensions *Power Distance*, *Uncertainty Avoidance* and *Individualism*. Further, these metrics were applied on to business process models of a German and an Indian company. We demonstrated that our metrics are applicable and that they provide further insights into the cultural characteristics of the two companies. We derived tendencies of the characteristics for the German and Indian companies and compared them to those of Hofstede et al. [8]. By applying our metrics in two companies in Germany and India, we can support the theory that it is possible to measure cultural characteristics in business processes.

The proposed approach for measuring national culture based on business process models contributes to both research and practice. So far, cultural research has mainly relied on surveys to measure underlying assumptions and espoused beliefs and values for identifying national culture. We contribute by presenting a measurement approach to measure culture based on documented actions and behavior, thus providing a transparent, independent and unbiased analysis of the underlying cultural dimensions. For practice, we see several areas of contribution. In the design phase of BPM, our metrics support the modelers e.g., by checking whether the process they design fits the cultural expectations of the involved parties. Our metrics can also support in the process analysis phase, e.g., by potentially identifying cultural problems causing performance issues. Furthermore, the analysis of the national culture in process models can be applied when measuring the cultural fit of two companies, e.g., at mergers and acquisitions.

However, our research is not without limitations. The processes in a company are not only subject to national culture, but also to other influencing factors that affect the process design. In each particular setting, these factors need to be analyzed in detail. Especially the interdependence of organizational culture and national culture – even though distinguishable due to different cultural dimensions [17] – needs to be analyzed. Further, as objects in a process model may be seen as boundary objects, literature from this adjacent field will be considered, too, in our upcoming research [34].

In terms of further research, our approach has to be expanded and evaluated: First, for a better interpretation and evaluation of the resulting values, further applications of the metrics in different companies, business processes, and countries are necessary. Second, we will investigate further characteristics which are capable to operationalize characteristics in the dimensions *Power Distance, Uncertainty Avoidance* and *Individualism*. Third, to expand our approach, we will define metrics for further cultural dimensions like e.g., *Masculinity, Indulgence* and *Long-Term Orientation* [8]. Fourth, it is necessary to apply the metrics to further settings to allow for a better evaluation and to establish a benchmark value for each individual country, process type, and industry. Last, even though process models are a means of quality documentation in companies, their quality and topicality cannot always be ensured. Thus, we will define requirements

to determine which processes our metrics suit best, e.g., to identify the influence of different modeling notations on our metrics.

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